GAS IN INDUSTRY

MAY 1960

Vol. 3 No. 24

FEATURES

MUSICAL INSTRUMENT MANUFACTURE—GAS AT BOOSEY & HAWKES LTD.
By Eric Ford.

INDUSTRIAL GAS IN THE SOUTH EASTERN AREA.
By W. J. Hewett.

EPSOM SALT INSULATION PROBLEM SOLVED BY NORTHERN GAS BOARD.

FACTORY KITCHENS — THE FIRST OF A NEW SERIES ON INDUSTRIAL CANTEENS.
By 'GAStronome.'

NEW STOVING OVEN AT W. & T. AVERY WORKS.

GAS PROVES ITSELF IN DIESEL FACTORY.

Published by

WALTER KING LTD
11, BOLT COURT FLEET STREET
LONDON, E.C.4.

Telephone: FLEet Street 2236-7
Telegrams: Gasking, Fleet, London

Editorial

Service—the key to sales

THERE are two ways of looking at most things, gas boards included, and in this journal we have published articles written from viewpoints both inside and outside the gas industry. The manufacturer is interested only in effective production and if the gas industry can provide the right service at the right price, the gas board is in business. The gas board, on the other hand, has as its prime concern the sale of gas, in which activity it finds it necessary to employ specialists capable of backing its sales efforts with service. It will be seen therefore that although the two viewpoints are very different, they have a point of contact in the magic quality of service.

Experience has taught the industrial fuel user to value service as a necessary addition to the other qualities of price, availability and efficiency. Gas boards have built up over the years an understanding of what the consumer needs and expects, and because they have been offering a fuel *service* for much longer than any other industry in the fuel field, they are now in a position to develop, manufacture and service equipment in a way which is unequalled by other industries.

As we said at the outset, in this journal we publish articles written from the viewpoint of the gas boards and of their consumers. The former are usually in the form of papers which have been presented by industrial gas engineers for the information of their colleagues. 'Industrial Gas in the South East', which appears in this issue, is a case in point. The theme is what must be done to increase gas sales, but throughout the emphasis is on service.

The South Eastern Gas Board serves an area in which light industry predominates, particularly the food and luxury trades, and its 8,000 industrial consumers use 40 mill. therms a year, an average of 5,000 therms per consumer. This is a relatively low figure, the result of the type of industry obtaining in the area, but it nevertheless represents an extremely important business and one which by its nature makes heavy demands on the Board's development and service staffs. That the Board regards these activities as essential is clearly brought out in the paper, and we would like to quote certain of the statements made by the author, Mr. W. J. Hewett, in the course of his address.

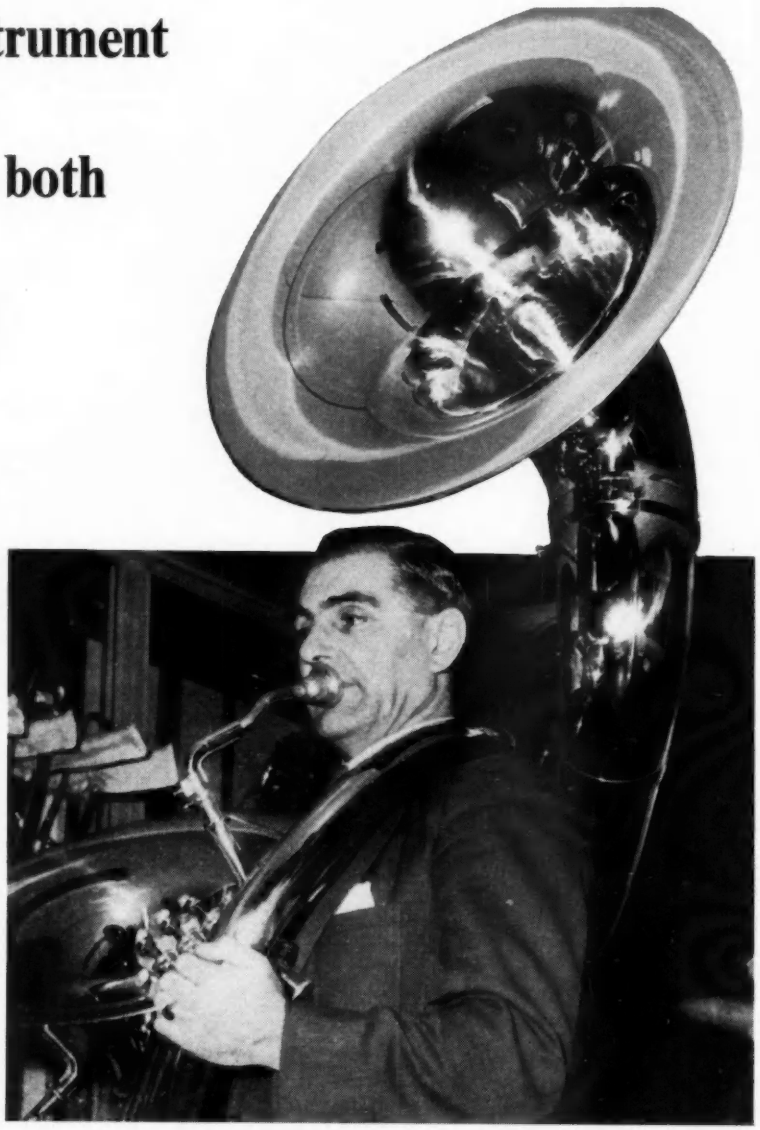
'The gas industry can offer a round-the-clock service for dealing with delays and breakdowns,' he says, 'and no other fuel than gas can give an equally good service . . . Such a service is an insurance to our customers against loss of production. What can be done to help our customers increase the efficiency of gas usage and thus reduce the cost per unit of manufacture? The answer is to provide technical staff capable of measuring the heat requirements, the efficiency of their processes and, with experience and ability, effecting improvements. Gas equipment may have to be designed and made specially for the job, and here the industry has a big advantage over its competitors, for it knows its customers better and the needs of their processes, while gas as a fuel is often easier to use.'

That is how the gas industry approaches its consumers. That is why it will succeed when other fuels fail.

TRADITION & PRECISION

The musical instrument craft maintains both with the aid of

GAS



By ERIC FORD

EVERY player of brass, wood wind and percussion instruments has a special regard for the firm of Boosey & Hawkes Ltd., the products of which are prized by musicians throughout the world. In famous orchestras of international repute, as in the least pretentious of village bands, musicians treasure the instruments which bear the name of this firm, whose Middlesex works are the largest devoted to musical instrument manufacture in Europe.

Each week the Sonorous Works produces upwards of 1,000 instruments, ranging from larger types like the euphonium, trombone and bassoon down to clarinets, flutes and piccolos, The manufacturing and finishing processes in this factory require a considerable amount of heat and Boosey and Hawkes are heavy consumers of gas; their consumption in 1959 was 18,834,200 cu.ft.

Important change

During the lengthy period in which the firm has been manufacturing musical instruments an important change has taken place in its production processes. Until comparatively recently, much of musical instrument manufacture was carried out by hand. After the second world war, however, the shortage of skilled craftsmen and the rising demand in export markets led to introduction of mechanisation in many processes.

Far from lowering the quality of the product, introduction of up-to-date engineering methods and processes has resulted in instruments of even finer quality than before.

Although it is perhaps too much to claim that musical instruments are produced at Boosey & Hawkes on production lines, it is certainly true that the firm's 700 work-people are using techniques and equipment equal to the best in other fields of industry.

Many of the techniques now being used involve the cold working of brass tube and sheet, for these materials form the basis of the brass instrument manufacture which makes up the greater part of the firm's production. Frequent annealing is necessary in many of these operations and this is done by a variety of gas-fired equipment, the most impressive of which is a continuous annealing muffle furnace, manufactured by Modern Mechanisations Ltd.

Brass components for annealing pass through this furnace on a variable-speed metal chain-link conveyor powered by electric motor. This first

of all passes through a flame curtain in the initial compartment of the furnace, which prevents the movement of air into the furnace. This is succeeded by a water-jacketed section which leads in turn to the pre-heating chamber.

From this section, the components, still on the conveyor, enter the main heating zone of the furnace where operating temperatures are in the region of 650°C. There are six aerated low-pressure gas burners, three on each side of the furnace.

Leaving the main heating zone, brass components pass out via an exit compartment, another water-jacketed section and a final compartment containing another flame curtain. The time taken to pass through this annealing furnace averages 30 minutes.

A governor is fitted to the gas supply in this furnace to ensure constant operating pressure and, in addition, an Electroflo instrument controls a motorised valve which maintains a constant working temperature at the pre-determined level.

Originally, the furnace was designed to incorporate a special furnace atmosphere but this has now been discontinued. However, the curtain has been retained at each end and the water jacket provides for the gradual heating up and cooling down of the components to be annealed.

Many different parts of brass instruments are annealed in this furnace. It is perhaps not always realised how many different U-tubes and other shapes of brass tubing go into the average brass instrument. Tube bending is carried out at Boosey & Hawkes by a particularly interesting method, for which effective annealing is vital.

Producing a tube bend

Suppose, for example, it is desired to produce the 180-degree bend for the branch of a tuba, which will commence as a piece of brass tubing of 70/30 composition, four feet long, 1½ in. diameter and .040 wall thickness. Under the method developed with great success at Boosey & Hawkes Ltd., the wall of the brass tube which will eventually form the outer radius of the 180-degree bend is compressed by a special tool in a press until it makes contact with the opposite wall. This process is known as 'dimpling.'

In this form, the 'dimpled' tubing can easily be bent to the desired curvature, for example, by pressing it into contact with a shaped former. By applying the necessary force when the tube is in this compressed (or 'dimpled') condition there is no risk of the tube collapsing inwards as would obviously happen if a piece of tubing were to be bent in its normal shape.

For the next stage of the process, the 'dimpled' tuba branch is placed in a special split die to give it the shape of the final product. When the two halves of the die are closed, one end of the 'dimpled' tubing is blanked off and hydraulic fluid introduced under pressures which vary between 1½ and 5 tons per square inch, depending on the nature of the work. This has the effect of causing the compressed tube to expand in an attempt to fill the space in the die.

Annealing the tube

Once the initial expansion has begun, however, the pressure is released and the tube taken out for annealing. After annealing, it is once again placed in the die and hydraulic pressure once again applied. Depending on the nature of the job, the annealing process may be repeated several times during this 'blowing' process.

If the bend is a particularly severe one or the amount of expansion required is very large, as many as eight or nine separate stages of expansion may be required, each one demanding an annealing operation. The importance of the gas-fired annealing furnaces and other equipment at Boosey & Hawkes Ltd. can therefore be realised, particularly when it is remembered how many and intricate are the bends which can be seen in the average brass musical instrument.

This method is not only employed on the larger components of the type just described but is also used for the numerous little components, technically known as 'knuckles,' 'tuning bows' and the like, which form part of the smaller instruments such as cornets and trumpets. These are frequenty made in 'snakes' of ten or 12 at a time and later cut to size, thus saving a great deal of time as compared with previous individual methods.

But however the 'dimpling' technique is employed, annealing is the indispensable factor in its success. For this purpose, in addition to the continuous annealing furnace, Boosey & Hawkes Ltd. also have a smaller, batch-type annealing furnace which is sited in a separate part of the general brass-working department. This furnace is also gas-fired and is used for smaller, more specialised components.

In some cases, annealing is done by hand-operated gas-fired torches, a large number of which are continually in use. These are of standard patterns and are fitted with pilot burners. Each is sited conveniently to the work being done and can be used as required by the operator whose safety, and that of others in the same area, is ensured by the provision of firebrick enclosures around each torch.

Bugles and sousaphones

An example of the use of these torches for annealing purposes is seen in the manufacture of the bell of the brass instrument. This may vary from the small bell of the Boy Scouts' bugle to the magnificent flare of the sousaphone.

A bell begins as a sheet of brass. This is cut to pre-determined shape and beaten manually around an appropriate former. During this operation frequent annealing is required and this is carried out, in the case of the smaller bells, in the batch-type annealing furnace, while the

Boosey & Hawkes Ltd. produce musical instruments which are famed for their careful craftsmanship and superlative finish. As can be seen, gas is used in the delicate operation on which this craftsman is engaged.

Hardly recognisable as yet, an embryo brass instrument is being treated by a gas-fired torch at an early stage in its manufacture.

larger bells are annealed by gas-fired hand torches.

Boosey & Hawkes make their own dies for the expansion of the 'dimpled' tubes and gas is also employed in this section of the factory. The dies are made from 'white brass' (zinc 84%, copper 12% and aluminium 4%, which is melted down in a gas-fired crucible furnace.

The molten metal is ladled from the crucible and poured by hand into plaster asbestos moulds. These moulds have previously been dried in an oven fired by bar-burners as the final stage of their manufacture. The drying process takes about 12 to 14 hours at 320°F.

Lead dies are used in the drawing of tapered tubes and these dies are cast in this department too, the lead for this purpose being melted in another gas-fired crucible furnace.

Gas and brazing

Gas is widely used for brazing. For instance, after the bell is beaten roughly to shape on the former, the seam is brazed and a triangular gusset brazed into position to form part of the bell flare. Following this, all seams are hammered flat by mechanical hammers and finally the completed bell is again beaten and then spun over a mandrel on a lathe-like machine to its final shape.

All the various components of brass instruments, such as bells, trombone slides, valves, tubes of various sizes and shapes are produced in one large and well-laid-out shop. They are assembled in another equally well-organised department, the brass assemblies shop, where long rows of benches are fitted at regular intervals with gas-torches. All these benches are fitted with their own gas and air supply lines.

Gas is widely used at Boosey & Hawkes Ltd. for many delicate jobs in the assembly departments. Here, the parts of a flute key are held in a specially devised jig, while a gas-fired torch is used to silver-solder them together.

This section of the factory is a particularly impressive sight for it is well-lit and the gleaming brass of instruments in various stages of assembly adds a distinctive touch of colour. A wide variety of operations is in progress, particularly the use of gas for brazing and silver soldering.

Some of the smaller components are assembled by means of this latter technique. They are dipped in borax and dried gradually by gas. Solder is loaded at the knuckles and then brazing takes place.

Although, as their name implies, woodwind instruments are mainly non-metallic in construction, certain components, particularly the keys, are made of metal. Clarinets, for example, are made of African blackwood, but this instrument has 21 keys and many other metal parts. The clarinet key is not exactly a simple piece of apparatus and, for each key, the touchpiece, cup and barrel has to be silver soldered to the actuating arm.

For this operation, the keys are accurately placed on special jigs and silver soldered as a mass-production operation. Another special jig has been devised for soldering flute pillars on to the body.

Polishing processes

By the time the embryo musical instrument is ready to leave the assembly department, it is easily recognisable. The final stages, however, include the various polishing processes, some of which, with the larger and more complex instruments, have to be carried out in stages. In such cases, a preliminary polishing is given to sub-assemblies for ease of handling and then the completed instrument passes through its final polishing before lacquering.

Brass instruments are lacquered in order to preserve their fine finish during the working life of the instrument. A preparation shop is attached to the lacquering room because, before the lacquer is sprayed on to the instrument, it is essential that the surface should be free of dust or grease. The preparation equipment includes a gas-heated trichlorethylene de-greasing plant.

Under heat, the trichlorethylene vaporises and rises to perform its

Left: *A small gas-fired batch-type annealing furnace being charged with components.* **Right:** *Molten metal being poured into a die. The metal has been melted by gas.*

cleansing action on the instruments suspended in it. Cold water piping round the top of the tank causes the vapour to condense and the condensed material runs back into the tank at the bottom, to be vaporised again.

Great care is taken of the instrument after it has been prepared for lacquering in order to prevent any dust or grit adhering to it before or after the lacquer is applied. For this stage, the instrument is taken into a separate lacquering room containing two spray booths and the lacquer curing oven.

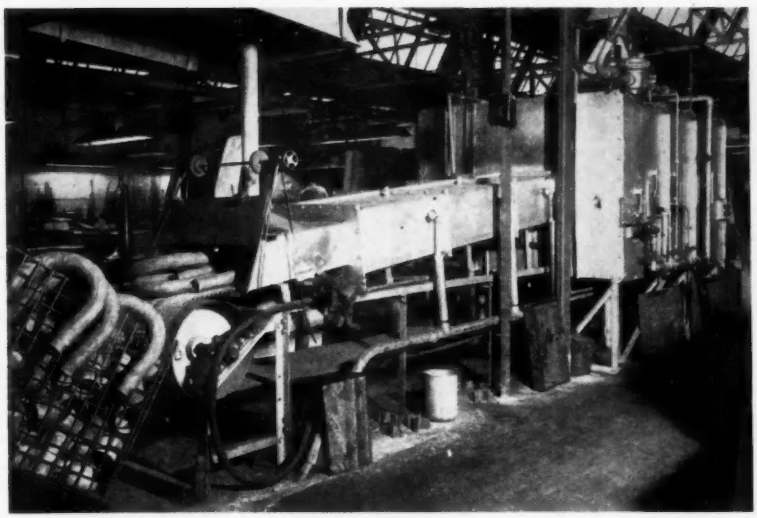
Great skill needed

Specially cleaned air powers the lacquer sprays and the enclosed booths are fitted with water curtains at the rear. Great skill is needed to ensure that every part of the instrument is properly covered with lacquer. After lacquering, the instruments are suspended in the curing oven which is about 12 ft. wide, 7 ft. high and 3 ft. deep.

Time taken for curing naturally varies considerably with the type of instrument being treated but the average is about an hour at temperatures in the region of 270°F. The oven is indirectly heated, the gas being burned in tubes. The burners themselves are outside the lacquering shop. The oven temperature is recorded by a Cambridge instrument and a continuous record kept. The working temperature is controlled by a solenoid gas valve and this in turn is controlled by a Negretti-Zambra controller. A water gauge indicates whether the gas supply and pressure are on or off. Entry to the oven is by two doors opening outwards.

These doors are flush to the wall of the room, the oven itself extending into the room beyond. It is here that the two burners are situated, firing into the combustion chamber below the oven. Flame protection equipment is fitted and controls the gas to each burner separately. In the event of flame failure, the gas supply is automatically cut off and can only be restored by re-setting manually and relighting the burners.

The bell of a large brass instrument undergoing the spinning process on a lathe-type machine.



Tuba branches are here seen leaving the continuous gas-fired annealing furnace. These components were originally 'dimpled' before being given this 180° bend and are now being annealed after 'blowing' to size by hydraulic means in special split dies. Annealing is of vital importance in this unusual operation.

After lacquering and finishing, the brass instrument is ready for final tuning. In fact, because of the exceptional accuracy of manufacture, final tuning is seldom if ever necessary. The processes employed, which in many cases involve tolerances down to .0002 in., mean that all the instruments in a particular range are identical and therefore no final adjustments are needed.

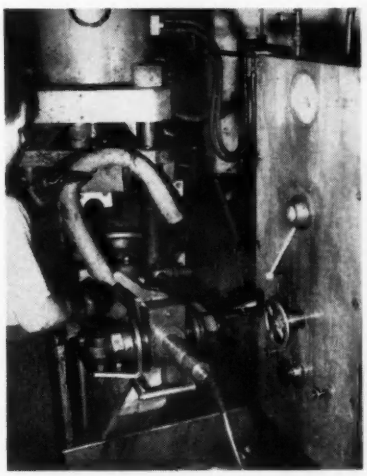
Testing and tuning

Nevertheless, each instrument when completed is sent to one or other of the firm's testing and tuning staff who carry out the final tests in sound-proof rooms. These men are all experts and, from the way in which they handle the wide variety of instruments sent for testing it is obvious that they have had wide experience with brass instruments. Indeed, it comes as no surprise to learn that most of them are past or present band masters.

Not all brass instruments pass through the lacquering department, for some by-pass this section in order to be processed into silver instruments for the many silver prize bands which are renowned in all parts of Britain. Gas is extensively used in the plating shops where the equipment includes various tanks in which the instruments are dipped for treatment, including an I.C.I. trichlorethylene degreaser of the type already described in the lacquering department. After plating, the silver instruments are polished and finished with the same care as that bestowed on the brass.

In addition to brass and woodwind, Boosey & Hawkes also manufacture a wide variety of percussion instruments.

A certain amount of gas is used



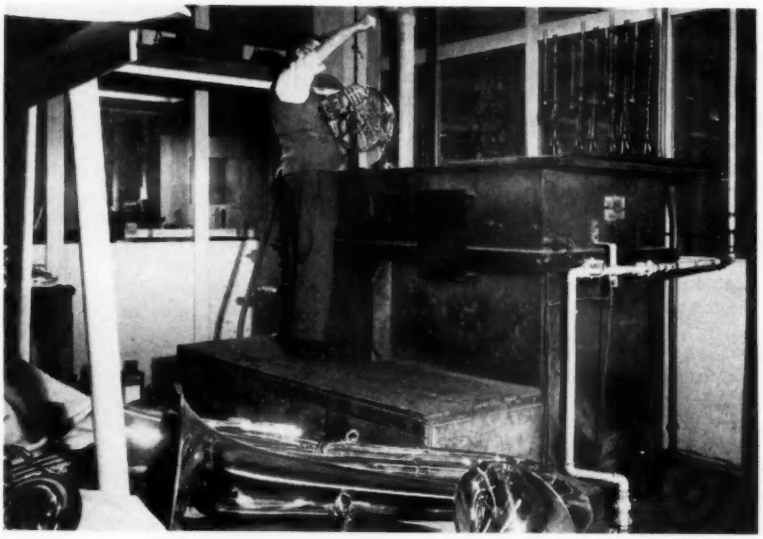
Close-up of the press in which tubes, after 'dimpling' are blown up to size. The top half of the split die can be seen in the raised position. A tube of this shape may be annealed as many as nine times in the course of this operation.

in the percussion department, particularly in such applications as brazing parts of tuned percussion instruments and drum fittings. Gas torches are used for this purpose. Gas-fired gluepots are also seen in this department for the many wood-gluing operations needed in the manufacture of drums of many different kinds.

Basic work on the production of woodwind bodies is carried out in the wood mill department, where the rough blocks of African blackwood are received and cut down, first into rectangular shapes and then into the tubular form required for clarinets, flutes, oboes, bassoons and the like. In the process, up to 90% of the original wood is jettisoned.

This department contains a space-heating plant which heats both the wood mill and the canteen. The apparatus used is gas-fired and is fitted with two burners. The air in these departments is warmed by passing it through an indirectly heated chamber consisting of a number of tubes. Each burner is controlled by flame protection equipment so that in the event of flame failure the gas supply is cut off and cannot be restored until the protection equipment has been manually re-set and the burners re-lit. Thermostatic control is provided.

Warm air from this plant passed via overhead ducting to the well-appointed canteen which is serviced by airy and modern kitchens in which gas is extensively used. The hot water requirements for vegetable preparation and dish washing are provided by a gas-fired water heater.



Prior to lacquering, brass instruments are placed in a trichlorethylene de-greasing tank. Here a French horn is about to undergo the treatment.

There can be few firms which have had to face as complete a reorganisation of their production methods since the end of the second world war as Boosey & Hawkes. They have had to rapidly mechanise an industry which was previously almost entirely the preserve of skilled craftsmen using hand methods. What in effect the firm has done is to graft modern techniques on to the accumulated craftsmanship of more than a century to produce a range of musical instruments which are the equal of any produced in the world.

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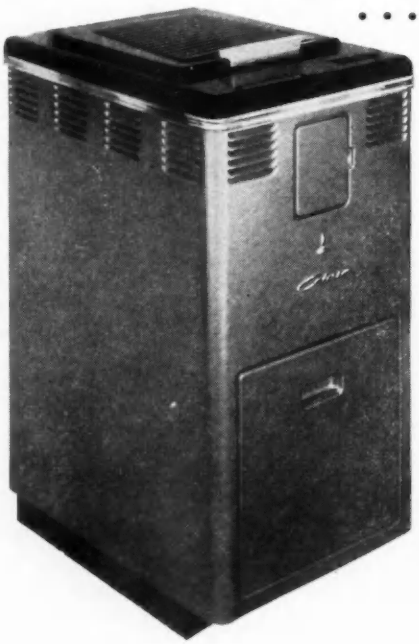

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A NEW SERIES BY 'GASTRONOME' ON INDUSTRIAL CANTEENS AND HOW THEY CAN BE REPLANNED

FACTORY KITCHENS—1

MUCH has been written about the planning of industrial restaurant kitchens—mostly as if it were a specialist's subject in itself which, of course, it is not. The preparation, cooking, and presentation of food for factory employees differs very little from any other class of large-scale catering.

The object of this series of contributions, however, is to indicate to industrialists and their managements what to look for in approaching replanning of their factory kitchens. It is proposed to give some examples, with diagrams, which might be adapted to their own needs.

The term 'canteen facilities,' often used in advertisements as an additional attraction to workers, may mean anything from a snack bar to full restaurant service.

It can also mean anything from the dismal to the splendid—for both extremes are to be found in industrial catering. The ideal, to my mind, is simply the provision of adequate service in pleasant, relaxing surroundings.

Many who treat staff welfare as a contribution to the efficiency of industry may be contemplating extending the meals service or re-organising an existing kitchen which is not keeping pace with demand or the eating trends of the day.

As one who has visited industrial restaurant kitchens throughout the country I would say that well over 80% need to re-organise their methods, equipment and layout for at least one of the following reasons:—

- Demands on the kitchen are excessive for the equipment originally installed.
- The kitchen has been fitted with the second-rate equipment common in the years of shortage immediately after the war.
- The kitchen has been indifferently designed, with no positive sequence of cooking and food preparation.
- Organisation of the kitchen has not kept pace with the installation of equipment, resulting in misuse, abuse and deterioration in general. This is perhaps the most commonplace of all the reasons.
- The kitchen needs to be re-sited in the works.

So far as the costs of re-organisation are concerned, two things need to be borne in mind: First, that it is better to delay replanning until the whole of the necessary cash is available than to attempt to carry out the work in stages; secondly, that the replanning should be on a permanent basis. The matter is unlikely to be considered again for a very long time, so that specialist knowledge should be enlisted from the start.

A good layout of equipment sited against a wall.

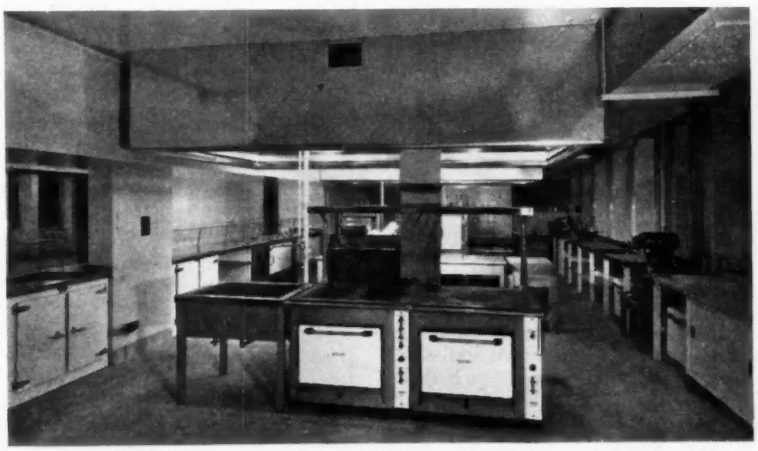
'The term "canteen facilities" can mean anything from a snack bar to a restaurant, from the dismal to the splendid'

Variations of kitchen design can be applied to several requirements. Generally speaking, there are two categories: (1) The open kitchen, and (2) the divided kitchen. For the first category the equipment required can be classified as main cooking ranges and auxiliary equipment; for the second, dispersed and specialist cooking equipment for particular preparations.

Briefly described, the 'open kitchen' aims at having an unobstructed view of storage, preparation, and cooking facilities. The advantages of it are that a minimum of kitchen staff is needed, the kitchen has the maximum light and air, and the design always looks good—provided, of course, that the staff keeps it that way. Capital costs for equipment and installation and maintenance costs, are low compared with those of other designs of kitchens.

The open kitchen, which depends upon daily deliveries, contributes towards the ideal of freshness in food.

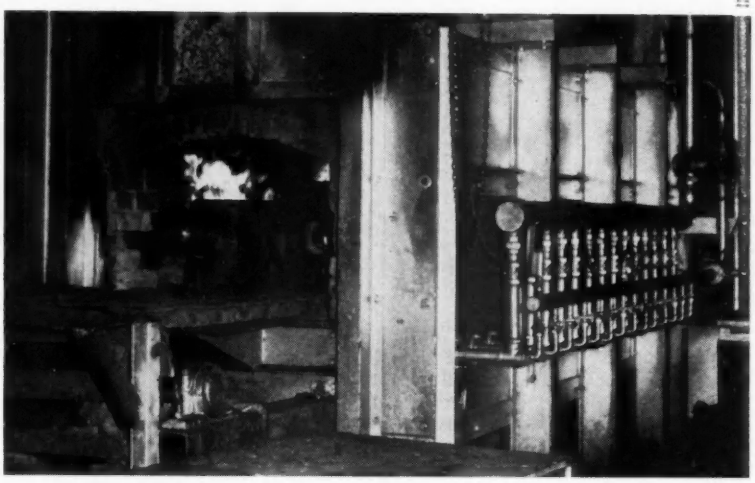
Continued on p. 142.



A fine example of a well-lit and well laid-out industrial restaurant kitchen.

In over a dozen ways gas proves itself

MILLIONS OF CUBIC FEET USED IN DIESEL FACTORY



An annealing oven used for welding processes in diesel engine manfacture at the Dursley factory of R. A. Lister & Co. Ltd.

TOWN gas plays an important part in the production of diesel engines at the Dursley works of R. A. Lister & Co. Ltd., in Gloucestershire. In a year some 66 mill. cu.ft. of gas are used in more than at dozen processes which include drying, melting, annealing and welding in addition to factory space heating.

Cast-iron components are made in Lister's own foundry, and here gas is used for treating the silica core sand and the finished cores. Over 200 tons of sand are dried each week in a gas-heated inclined rotary drum dryer and once the cores have been pressed they are dried and baked in a large continuous gas oven.

Final drying

Further core treatment involves dipping in a surface smoothing liquid, and final drying is by direct gas flame. The cupola furnace for iron melting uses gas for the initial heat, a flexible gas pipe enabling a gas burner to be introduced into an inspection port.

Many forgings and castings are annealed before use and the annealing stoves, together with a large anti-scale pre-heating furnace for preparing large castings before welding, are all gas fired.

Parts are cleaned in gas-heated degreasing and washing tanks, and dryers. There is also gas equipment for drying the air used in shot blasting machines. Muffles are used for a number of processes and the majority of these are gas heated.

Annealing furnaces

Steel sheet is welded by town gas and there are gas-fired annealing furnaces for handling steel between deep drawing press operations.

At the pipe works gas is used in the brazing of copper and steel pipes, rotary brazing machines being installed to handle large numbers of pipes simultaneously. Automatic control provides an exact gas burner adjustment and brazing cycle.

Before despatch all the diesel engines are spray painted and they then pass on a moving track through a gas-heated paint drying cabinet. The high output of the engines results in the almost constant use of the dryer.

Gas requires no storage at the factory, but has proved itself a clean, smokeless, fuel which has a constant heating value. It has an infinite and swift turndown ratio which means that fast initial heating and automatic control can be incorporated with ease in heating plant design.

Austin Lowe to co-ordinate furnace sales for Gibbons

MR. J. AUSTIN LOWE, Managing Director of Thermic Equipment & Engineering Co. Ltd., Preston, and a director of Gibbons Applied Atmospheres Ltd., Birmingham, is shortly to move to Dudley to co-ordinate sales within the various furnace divisions and subsidiary companies of the Gibbons group.

Mr. Lowe has been in control of Thermic Equipment & Engineering Co. Ltd. for the past five years during which time many new ranges of gas- and oil-fired furnaces and burners have been successfully developed.

He has also been responsible for modernising production facilities at Preston, where the works have been almost completely retooled and where new erection bays have been built incorporating modern handling equipment.

Mr. Wilkinson, who has been responsible for special combustion and the burner department, has been appointed General Manager of Thermic.

Crittall-Aquafont goes overseas

AN arrangement is being made with the A.E.S. Trading Company of Melbourne to introduce the Crittall-Aquafont range of catering equipment throughout Australia.

A.E.S. is responsible for supplies to Ansett Transport Industries Ltd.

In accordance with the Group's policy to extend its overseas sales R. O. Hamilton, Ltd., of Nairobi, a large firm of importers and distributors, has been appointed agents for Crittall-Aquafont in Kenya, Uganda, Tanganyika and Zanzibar. The first orders from this area includes 14 Coffeemasters and a variety of urns.

Industrial gas in the South East

By
W. J. HEWETT
Area
Industrial
Engineer

South Eastern Gas Board

IN the South Eastern Gas Board's area of supply there are approximately 8,000 industrial consumers burning 40 mill. therms per year, an average of 5,000 therms per industrial consumer. The national average is 8,300 therms and the boards with heavy industrial loads average 17,000 to 20,000 therms for each such consumer per year. Not every factory needs gas for process work but all need it for welfare services, that is for hot water, heating and catering.

It is the process load which gives us the variations in average consumer demand; while the welfare services show a definite relationship between the number of employees and the gas consumed, the load is more closely related to the degree of industrial prosperity. The basic load—welfare services—is a static load, but the process load is capable of big expansion. This is clearly shown in the national returns of fuel consumption for the past ten years.

What are the main factors to be considered in selling gas in the South Eastern Board's area?

The understanding of the needs of the local industries is a pre-requisite to planned selling. What loads are there for any fuel and what is our possible share? Price is a major consideration because it has a direct effect on working costs and profits, but it is the cost of gas per unit produced that matters and not the cost per therm. What can be done to make the true cost of gas equal to or less than other fuels? First and foremost there is service in its widest sense.

Increased efficiency

The gas industry can offer a round-the-clock service for dealing with delays and breakdowns, and no other fuel than gas can give an equally good service. Delays in production are very expensive and with the growth of mechanised and automatic operation, such a service will increase in value; but it must be backed by a perfect distribution system and a gas of constant quality, and needless to say, the sulphur content of the gas must be kept as low as is practically possible. Such a service is an insurance to our customers against loss of production. What can be done to help our customers increase the efficiency of gas usage and thus reduce the cost per unit of manufacture? The answer is to provide technical staff capable of measuring the heat requirements, the efficiency of their processes and, with experience and ability, to effect improvements. Gas equipment may have to be designed and made specially for the job, and here the industry has a big advantage over its competitors, for it knows its customers better and the needs of their processes, while gas as a fuel is often easier to use.

It is this service with which the author has been most closely associated, and although it is not a cheap service to provide, its extension offers the best opportunities for increasing the load. This is particularly true in the higher priced regions.

The industrial organisation of the South Eastern Gas Board is well equipped to give a full service to the consumer and to take advantage of any opportunity that may arise to increase the industrial gas load. The Industrial section at Headquarters is under the control of the manager of the special service department and is administered by the industrial service officer.

Approximately 85 to 90% of all industrial enquiries received are dealt with at divisional level, including a certain amount of local development work. In the main, these enquiries are for standard appliances. An enquiry that does not fall into this category is either, (a) of an intricate nature, (b) in need of considerable development work, (c) to be designed to meet specific requirements, or (d) to be modified or adapted to existing plant. Such an enquiry would be referred to the industrial service officer, who would then delegate an area industrial engineer to take over.

It is the duty of this engineer to prepare a scheme and estimate for consideration, and if accepted to take full responsibility for the design, construction and installation of the equipment needed to meet the enquiry. He works on an area basis and his services are available to all industrial staff anywhere in the Board's area of supply. In addition, the area engineer has to deal with special complaints, or to carry out tests on existing installations. He can have the services of a draughtsman, when required, to work with him full time on the completion of any project on hand.

Liaison with the industrial laboratories is essential; it is here he receives most assistance in the way of development and experimental work. Any equipment made in the industrial workshop is tested in the laboratories and a report is submitted to the engineer concerned.

Enquiries handled

The industrial workshops are part of the appliance workshops, consisting of a large machine shop, sheet metal shop and general workshop. Complete industrial equipment to suit the needs of any consumer can be manufactured on the premises. The engineer has access to these workshops at all times and can thus follow the progress of any work in which he has an interest.

The types of enquiries handled by the area industrial engineers are so numerous that only a limited number of examples can be included, and an effort has been made to see that they are as representative as possible.

A gas fired steam superheater was designed for supplying superheated steam for closures on fruit preserving jars. In its construction, a $\frac{1}{8}$-in. o.d., 16-gauge stainless steel coil of 12 complete loops, is housed in a rectangular casing measuring $14\frac{5}{8}$ in. by $5\frac{3}{4}$ in. by $14\frac{1}{2}$ in. high, fabricated from 16-gauge M.S. sheet, the sides of which are insulated internally with a 1-in. thickness of insulating brick. The lining is supported on a copper channel frame fixed $1\frac{5}{8}$ in. from the base plate.

The coil is arranged in a horizontal plane, the loops having extended parallel sides and semi-circular ends disposed around a refractory tile

From a paper to the London and Southern Junior Gas Association.

housed by two vertical stainless steel sections, to which are fitted angle sections with multi-channels to support and maintain the spacing of the loops of the coil, the whole forming a complete withdrawable unit.

A two-armed burner is situated below the heating coil, and products of combustion pass up through the aperture formed by the casing insulation and the central tile, in which the coil is disposed. The products discharge to atmosphere through multiple flue outlets provided at the top of the casing.

Outlet concealed

Air for combustion is admitted to the appliance through a series of apertures in the base plate, directly beneath the burners.

A top cover is provided, also fabricated in 16-gauge M.S. sheet, in which a 1-in. thick insulating tile is clamped. The sides of the top cover extend downwards to conceal the flue outlets. A lighting port is provided, fitted with a pivoted cover.

The casing is finished in deep cream vitreous enamel, and all other exterior metal parts, with the exception of the supplies and controls, are nickel plated. Supplies and controls are stoved cream enamel.

The burner equipment consists of two ¼-in. B.S.P. barrel floats each with 13 Bray minijets, size W, at ¾-in. pitch, and carrying a fixing plate. Each barrel float is welded at 2¼-in. centres to a ¾-in. B.S.P. header. The burners are located by a removable guide plate at the end remote from the burner, and by the fixing plate, both of which are reversible.

Performance test

Data from combustion tests showed at a maximum normal heat input of 14,000 B.t.u. per hour on a flue gas analysis of 4.8% CO_2, .001% CO and less than .001 for the ratio of CO : CO_2. At a slightly higher heat input—representing a 20% volume overload—of 16,800 B.t.u. per hour, a flue gas analysis of 6% CO_2 with the other quantities similar.

A performance test gave the following figures:

Maximum gas rate—28.0 cu.ft. per hour.

Heat input—13,300 B.t.u. per hour.

Gas pressure at burner—1.7 in. w.g.

Gas used during test—20.2 cu.ft. (10,000 B.t.u.).

Time taken for test—45 minutes.

Ambient temperature—59°F.

Gauge pressure of inlet steam—15 p.s.i.g.

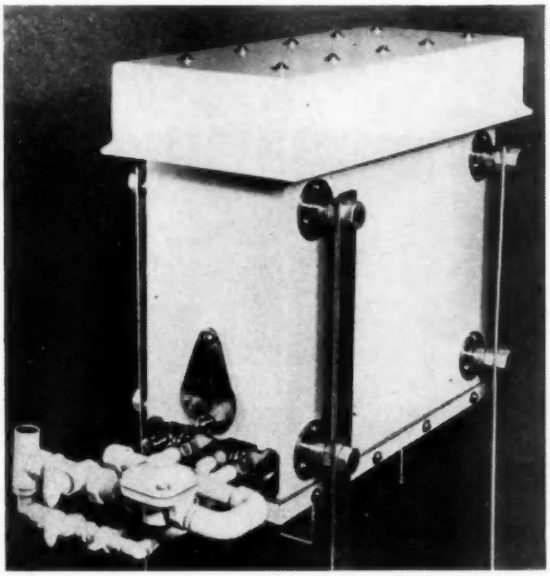


Fig. 1. A gas-fired steam superheater appliance for the closures of fruit preserving jars, designed by the South Eastern Gas Board.

Temperature of inlet steam—250°F.

Temperature of outlet steam—990°F.

Weight of steam superheated—8.50 lb.

Dryness fraction of inlet steam—0.86.

Total heat content of inlet steam—1,032 B.t.u. per lb.

Total heat content of outlet steam—1,526 B.t.u. per lb.

Heat supplied by superheater—494 B.t.u. per lb.

Nett thermal efficiency of superheater—41.6%.

The department set out to produce a pottery kiln for an art school, which was to have a high standard of appearance with such features as automatic ignition, flame failure protection, ease of control for burners, a damper, and very low surface temperatures throughout the casing.

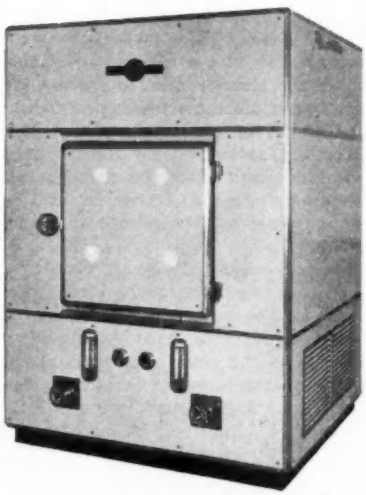


Fig. 2. A pottery kiln specially designed for an art school. It is fitted with automatic ignition and flame protection devices. Good thermal installation ensures a cool casing.

The working chamber size is 25 in. wide by 36 in. deep by 28½ in. high; for the main lining Morgan H.T. insulation M.I.28 was used, with the inner surfaces washed and sealed with a proprietary refractory glaze (Vincent Davis XIX/75) to reduce penetration during reducing conditions. Bag walls were of suitably dense refractory and the hearth was formed with fused alumina tiles. The kiln is used to follow an extended firing curve up to a maximum temperature of 1,350°C. and the curve can be recorded and repeated. Two non-aerated burners are used and a high degree of uniformity is achieved in the working chamber at the top temperatures.

The case is framed in polished light aluminium sections with removable panels vitreous enamelled Cambridge blue. It is air spaced from a mild steel basic case and the cavity is ventilated by polished aluminium louvres, the whole standing on a black wooden plinth. For fine control the damper is operated by standard window winding gear and a chromium calibrated scale shows its position. A trip switch interlocks it with a magnetic valve to ensure a minimum open setting when lighting. The burners are spark ignited and controlled for flame failure by standard electronic gear utilising infra red flame sensing, together with the usual audible alarm on shut down. Hand wheels, gauge frames, sight ports, door hinges, etc.,

are all chromium plated giving a standard of finish that compares favourably with the most modern industrial design. At 1,350°C. the case is barely warm over most of its surface minimising any danger of burns, etc., to students. The maximum hourly gas rate is 850 cu.ft. at 12/10 in. w.g.

The Board received a request from our consumer for a suitably designed furnace for use with his own muffle and capable of reaching 1,000°C. from cold within one hour. Tests were carried out on the furnace to determine its performance when arranged as a muffle furnace, and alternatively, with the muffle removed and replaced by a refractory tile to form an open hearth. The tests showed that a temperature of 1,000°C. were reached in 56 minutes when the furnace was being used as a muffle, rising to 1,100 at the end of 79 minutes. When used as an open hearth, the stipulated temperature of 1,000°C. was reached in 38 minutes, and 1,342°C. in 250 minutes. In both cases the gas rate was 220 cu.ft. per hour with a pressure at the burner of .8 in. w.g.

Muffle furnace

A muffle furnace was constructed for the chemical laboratory for the heat treatment of catalyst material at 1,450°C., from data supplied by the industrial laboratory. The furnace is heated by a non-aerated bar burner using low pressure gas under natural draught conditions. The burner has a single row of drillings—No. 50 Morse—at $\frac{3}{8}$ in. pitch, and is situated beneath a refractory radiation screen, firing through a longitudinal slot in the screen into the slot in the refractory lining beneath the muffle. A two stage combustion system is employed whereby sufficient air is entrained by the gas through the slot to maintain ignition at the burner, and additional air to complete combustion is admitted through the two ports at the base of the furnace.

A tubular silicon carbide muffle, measuring 12 in. long and $5\frac{1}{2}$ in. internal diameter, is fitted, supported by a longitudinal triangular bearer and two transverse bearers. The longitudinal bearer, besides giving substantial support to the muffle, shields the muffle from direct impact of the gases, and since it is parallel to the burner, also provides a useful means of improving the flow pattern of the gases through the furnace. Tests have shown that an extended muffle life is obtained by this system. Tests showed that a temperature of 1,000°C. was reached after 27 minutes, 1,300°C. after 78 minutes, and 1,450°C. after 187 minutes. These figures were plotted, and the curve is shown in Fig. 4. The gas rate was 300 cu.ft. per hour at a pressure of 2.2 in. w.g. at the burner.

Fig. 3. A gas-fired muffin toaster which has successfully replaced similar appliances fired by other fuels.

A gas fired crumpet toaster was designed for a customer; it is the duty of this particular appliance to compress the newly made crumpets to a uniform thickness within the ringed formers, and at the same time to slightly toast the tops. A conveyor travels intermittently at 6-second intervals, and during each of these periods the unit is geared to lower and retract. Originally this type of unit was electrically heated and was a continuous source of trouble during operation, but evidence that the gas unit proved satisfactory can be gathered from the fact that to date 11 have been supplied.

The appliance consists of a cast iron base plate 25 in. by 14 in. by $\frac{1}{4}$ in. attached to a 14-gauge mild steel casing lined with castable vermiculite and finished in yellow heat resisting enamel. The burner, fitted with 21 Bray minijets, fires through a rectangular opening and parallel with the base plate. The maximum hourly gas rate is 40 cu.ft. at a pressure of 19/10 in. w.g., which gives an average surface

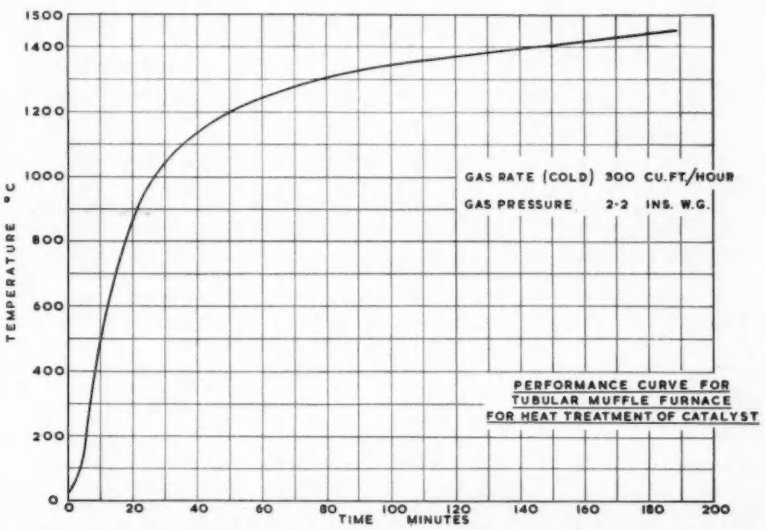


Fig. 4. The graph shows the rate of heating of a specially designed muffin furnace for catalyst treatment in a chemical laboratory.

temperature of the plate of 650°F.

A high proportion of the enquiries referred to us at headquarters are for conversion from other fuels to gas firing; these have included lead baths, steam and hot water boilers, bakers' ovens, and other types of appliances. Although such conversions may be the only alternative means of increasing the industrial load, they cannot be expected to compare favourably with a correctly designed gas-fired appliance.

We have, for example, converted several vertical cross-tube steam boilers with evaporations up to 800 lb. of steam per hour, with the best figure obtained at 2.8 cu.ft. of gas per pound of steam made, and efficiencies varying from 62 to 67%. Several bakers' ovens have been converted from solid fuel and some from oil with satisfactory results. The type of conversion unit installed depends on the type of oven involved.

Heaviest industrial load

Most of the Board's industrial consumers are connected with light industry, and in the main with the food and luxury trades, with the result that numerous small pieces of equipment, consuming gas at low rates, are constantly demanded; there are, however, several large concerns which have installed the Board's equipment, together with appliances by well-known makers. The Metropolitan Division of the Board (South London) has the heaviest industrial load, but here any increase could easily be offset by the movement of one large factory from the London area.

In the other divisions as a whole the position is encouraging, for here conditions are changing, with the result that coastal towns and areas generally associated with holidays are now gradually becoming industrialised to help balance their economy. Several small industrial estates have been built, for example at Thanet, and a large one at Crawley, and in each case a fair share of the potential load has been secured for gas.

Northern Gas Board's Industrial Department overcomes

EPSOM SALT INSULATION PROBLEM

THE successful technical co-operation between the Northern Gas Board (Tyneside Division) Industrial Department and the management of a large pharmaceutical manufacturing company in overcoming a problem which threatened to stop completely production of their main product, Epsom salt, is the subject of a recent report.

Reproduced from Report No. 677/58 of the Industrial Gas Development Committee of the Gas Council.

Epsom salt with a 50% moisture content is mechanically fed through a cascading screen into the first ring of the dryer. After separation, finely divided salt enters the second ring into which thermostatically controlled air at a temperature of 300/330°C. is induced through cyclones at a draught of 20 in. w.g. This air is recirculated through the first ring dryer and dust filter bag housing before exhausting to atmosphere. The filtered salt returns to the main feed and at the second ring dryer passes to the cooling duct via the cyclones. The air temperature to the cooling duct is controlled at 143°C. by a pneumatically operated gas valve on the outlet of the ring dryer. This ensures that the distribution hopper receives the salt with a moisture content of approximately 27%.

Gas passes through a 4-in. governor and a rotary meter relay valve with its weep controlled by a magnetic valve and a pneumatically operated gas valve to the two main Hypact burners. A pilot supply is taken between the rotary meter and the relay and is controlled by a solenoid valve. Ignition and flame protection are provided by Honeywell Brown electronic controls consisting of spark and flame detection electrodes. These work in conjunction with the solenoid valves fitted in the weep of the main relay valve and the pilot gas supply.

Temperature control

Temperature control is provided by two Negretti and Zambra controlling pyrometers. One acting as an overheat device set to operate at 300/330°C. is situated in the hot air inlet to the second ring and controls through the pneumatic gas valve the main supply to the heat exchanger; the other, which is the main temperature controller, is set to operate at 143°C. and is situated in the main feed from the second ring dryer to the cooling duct. The temperature of the material passing from the first to the second ring is indicated by a thermometer. Two 3,000 cu.ft. per hour Hypact main burners and one 600 cu.ft. per hour Hypact pilot burner were originally installed. The main burners were subsequently replaced by two Hypact burners each of 2,000 cu.ft. per hour. The entire plant was constructed by F. W. Berk Ltd., London.

The problem arose because the application of additional insulation to certain parts of the dryer and fans had upset temperature distribution, resulting in higher and unstable temperatures. As a consequence insufficient salt was being dried.

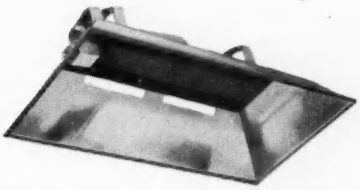
As additional insulation had been applied it was decided to reduce the heat input by the removal of one 3,000 cu.ft. per hour main burner. It was observed that the suction was some 4 in. w.g. lower than the normal 20 in. w.g. and from consultation with the designer this was found to be due to the filter bag texture and spacing, both of which had been changed at the same time. These were subsequently corrected. From further tests conducted by the Board's industrial staff it was found possible to effect a 30% reduction in gas consumption by substituting two burners each of 2,000 cu.ft. per hour in place of the original 3,000 cu.ft. per hour burners.

INSTANT FLAME PROTECTION DEVICE

THE new Perlotronic Type 90 flame protection control brings *instant* shut-off flame protection within the sphere of the less expensive appliance. Improved protection is thus made available in instances where initial cost has hitherto dictated the use of thermo-electric controls. A typical example of this is the large box oven.

The Perlotronic is an electronic flame protection control of completely new design. It is very simple to handle and maintain, and it can fail only to safety. It operates on the flame circuiting principle.

Metal radiant burner reduces refractory surface problems



The Van Dorn gas-fired infra-red overhead space heater.

AS sole licencees of the Van Dorn Iron Works Company, of Cleveland, Ohio, U.S.A., Getz Bros. & Company, of London, has recently started manufacture and sales of a new type gas-fired infra-red generator for overhead space heating and industrial processing. The equipment embodies a radical departure from the ceramic-supported surface combustion burner, the drawback of which is the rather fragile nature of a refractory quite often susceptible to mechanical shock and overheating.

Based on a careful study of ceramic element infra-red generators the Van Dorn iron works developed an all-metal radiant burner.

The Van Dorn infra-red generator is a fully-aerated burner providing 100% primary air supply and achieving complete and even gas-air mixture over the entire 60 sq. in. of combustion surface by means of an extrusion baffle in the centre yoke of the cast-iron burner plenum. Combustion of the fuel mixture takes place on the surface of an Inconel gauze assembly.

The physical characteristics of the various components of this mesh assembly were chosen to maintain perfect combustion and flame stability over a range of fuel inlet pressures and gas ratings. This enables the satisfactory operation of the generator from 500°C. to 800°C. surface temperature by merely varying the gas supply.

It is claimed that the use of Inconel, with its known anti-corrosive properties and heat resistance in the combustion gauze assembly, as well as in the booster screen, assures a practically unlimited life of the element even with the existence of sulphur in manufactured gas. While, with the use of low-pressure gas, a surface temperature of approximately 800°C. may be considered standard rating (at a normal input of 18,000 B.t.u. per hour), the use of pre-mix valves allows surface temperatures up to 1,000°C. without detrimental effects.

It is quite apparent that this possible modulation of surface temperatures considerably widens the scope of application in the processing field. Of equal importance is the reduction to the minimum of maintenance costs and service problems.

The Van Dorn equipment, which was seen for the first time in this country at the Gas at Work in Industry exhibition, will be available as space heaters and generators for industrial processing applications.

GAS AIDS T.V. TUBE RECONDITIONING

GAS gives you good viewing cheaper. That is the latest boast our industry can make according to the W.M.G.B's *Viewpoint* and it comes from Malvern where gas now plays a big part in the reconditioning of television tubes.

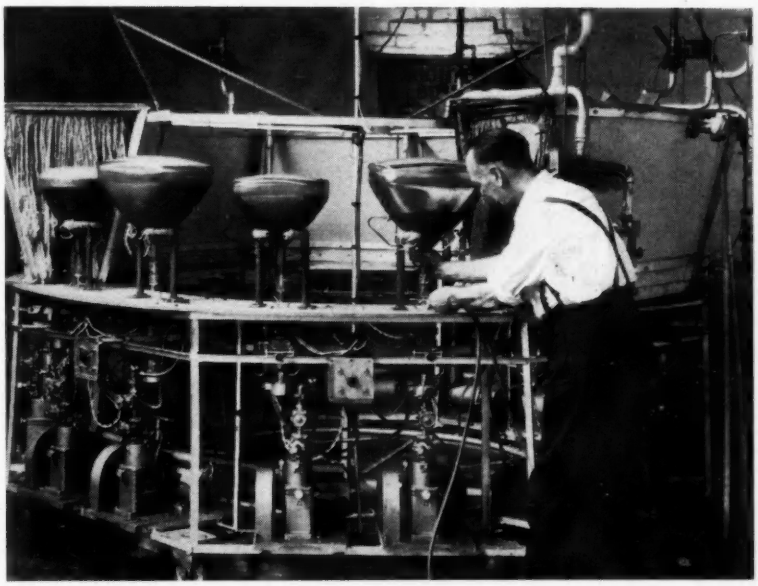
The firm concerned are Tube Electronics Ltd., who, during the time of the peak viewing season are reconditioning something like 5,000 T.V. tubes a week. In reaching that impressive figure they have been helped a lot by No. 6 Division's Industrial Department.

To write of 'reconditioning' the tubes is a little misleading. In fact, the firm makes what is virtually a new tube, re-using only the glass envelope of the old one. What goes inside is completely new.

First the neck is knocked off the old tube, the electron gun extracted and the inside of the tube washed out with acid. The inside face of the tube is re-coated with radio-active material and dried over a gas heater. At the next stage a new neck is fitted to the glass tube. Gas makes the join. Then into the neck is fused a new electron gun. The operative uses a mixture of nitrogen and town gas.

The tube moves on to takes its place in a gas-heated circular furnace. It passes through five 'zones' in two of which a temperature of 400° C. is reached. Simultaneously a vacuum pump is working on the tube and the combined effect is to exhaust it of impurities and create a vacuum.

Previously exhausting was done with the aid of electric infra-red apparatus, but gas has cut the time for the process from three to two hours. When the tube reaches the end of its journey round the circular furnace it is sealed off by gas. A metal cap is fitted and off it goes to be tested, packed and despatched. The furnace which is rotated by hand has a consumption of 600 cu.ft. per hour, but under construction is a new mechanically operated one which will be rotated at 2,000 cu.ft. per hour.



The gas-heated circular furnace in which the tubes are 'exhausted' and then sealed off.

GAS WINS CONTRACT

Improved paints need faster, more flexible, heat process

A GAS-FIRED forced convection paint-stoving oven for the continuous drying of spray-painted components has been installed at the Sherburn-in-Elmet factory of W. & T. Avery, Ltd., manufacturers of weighing, testing and measuring equipment.

The oven is 36 ft. long and 9 ft. high and incorporates a double traverse of the mechanical mono-rail conveyor system which is a feature of this modern, well-equipped factory.

The oven, which has been in use for many years, was formerly heated by natural convection using steam radiating panels. The introduction of new and improved paints, demanding higher curing temperatures and a shorter heating cycle has, however, called for new stoving techniques since the maximum temperature of the old equipment has become insufficient.

This factor, coupled with the desire to improve working performance generally, led Avery's to seek more efficient equipment.

Retained basis

Among concerns they approached was the Industrial Section of the North Eastern Gas Board's Wakefield Group, who submitted a design which proved of considerable interest to Avery technicians and management. The existing oven was of sound construction and the proposed design retained the basis of the main structure.

The Wakefield Group was therefore asked to quote for the work of conversion and, despite keen competition from other fuels, their quotation was accepted.

The Gas Board's work in the actual change-over was substantially lightened by the fact that Avery's agree to carry out modifications to the oven interior and to erect the staging and stairway.

The two heat exchangers and air trunking, together with canopies and flue equipment, were constructed at the Gas Board's industrial workshops and were installed, complete with fans and other equipment, during a Bank Holiday works shut-down.

Under working conditions, an electric time-switch starts the plant ¾-hour before the beginning of the working day. Working oven temperature is therefore reached in readiness for paint-spraying operations when workpeople arrive at the factory. Thereafter, the temperature is held constant by means of a Kent recorder/controller which can be pre-set to suit the work going through the oven at any particular time.

The heating is fully automatic, both for temperature and time control, and incorporates electric ignition of the burners, thermo-electric flame failure protection and a safeguard against fan failure.

Coloured signal lamps indicate when the gas valves operate and similar lamps on the flame-failure pilots serve to give early warning should any fault occur.

Gas supply is separately metered for costing purposes. Under normal working conditions consumption is tolerably close to the figure originally estimated.

It was anticipated that this new technique would result in increased output which could be ascribed to the higher mean temperature and the advantage of forced convection against the natural convection of former days. That desirable result has, indeed, been achieved.

But that is by no means the whole story.

Low level distributors, incorporated within the oven, allow work to be treated almost down to floor level, utilising an area which previously could not be used. Carrying trays have been extended to take advantage of this space and a further increase in through-put has resulted.

BRAY SHUFFLES SALES FORCE

MR. J. H. BRAY of Geo. Bray & Co. Ltd., who has been responsible for all London postal districts, has left the field sales force (home) to join the overseas sales force. His territory has been taken over by Mr. J. H. Rawcliffe who leaves the eastern territory, now taken over by Mr. G. A. Atkinson. In his two-and-a-half years with the company, Mr. Atkinson has been employed in the industrial heating department and this has been followed by a comprehensive training in the products of the other divisions of the company.

'GASTRONOME' ON FACTORY KITCHENS

—FROM PAGE 135

Also, this type of kitchen requires no walls or partitions, which means a greater measure of flexibility in cooking operations.

The divided kitchen may be so described when the various areas of storage, preparation, cooking, and washing-up are enclosed by ceiling-height walls or partitions up to 5 ft. tall. Its chief advantage is that there is segregation of processes, which is particularly convenient when the kitchen is cooking for 1,000 or more people.

Attention should be paid to staff organisation as the divided kitchen is prone both to labour wastage and to wastage of manual effort in cleaning areas and walls.

There is, of course, the kitchen where only one or two special areas are enclosed by walls or partitions.

Best approach

Going back to the open kitchen, where there are a main cooking range and auxillary equipment, here the bulk of the cooking is carried out on a range of two or more ovens with boiling tops of solid-plate or open-burner design, the steaming, deep-frying and grilling being confined to auxillary equipment. Such an approach is perhaps the best, especially when a high standard of cooking is demanded.

The grouping of equipment can be either of wall or central siting.

The grouping of specialist equipment is associated with kitchens providing for 600 or more people, where the preparation areas are separately staffed. For example, where pastry is cooked away from the other preparations, the need is for a separate pastry oven and steaming ovens.

Care must be taken when designing a kitchen incorporating the principles both of the divided kitchen and of the dispersed and specialist grouping, to see that expenditure on building and equipment does not rise to unnecessary proportions. It is important to realise that only the broadest generalisations can be applied to planning until individual cases are expertly assessed.

The next contribution in this series will illustrate alternative designs of kitchens, and indicate the appliances needed for given numbers of people to be catered for.